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The effect of seasonal heat on teaching and Learning and Mitigation Strategies: Philippine's context

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A R T I C L E I N F O

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A B S T R A C T

The Philippines, due to its geographical location and diverse topography, is particularly vulnerable to extreme weather conditions, including heat waves intensified by climate change. These heightened seasonal temperatures have significantly impacted classroom environments, making them increasingly unsuitable for effective teaching and learning. Hence, this study examined the challenges experienced by elementary teachers and the strategies implemented to mitigate the impacts of heightened seasonal heat. A descriptive phenomenological approach was employed to collect data through structured interviews with fourteen (14) purposefully selected public elementary teachers in the Schools Division of Laoag City, Ilocos Norte. The thematic analysis identified five primary challenges: increased teacher stress and burnout, diminished learners' focus and concentration, reduced participation and engagement, heat-related illnesses and rising absenteeism, and inadequate classroom ventilation, including malfunctioning electric fans. In response, teachers implemented instructional modifications and varied pedagogical strategies, utilized outdoor and nature-based learning activities, provided hydration support and comfort measures in the classroom, classroom ventilation and airflow management, and strengthened classroom comfort through improved ventilation. Despite teachers demonstrating resilience to heightened seasonal heat, the findings suggest that educational authorities and policymakers should invest in climate-resilient classroom infrastructure, including adequate ventilation and climate control systems, and provide specialized training to support teachers in managing environmental stressors and enhancing their teaching effectiveness.

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Introduction

As global temperatures continue to rise, the detrimental impacts of climate change are becoming increasingly pervasive across various sectors of society, extending beyond acute and catastrophic weather events to more gradual and persistent phenomena, such as elevated seasonal temperatures. The Philippines stands out as one of the most climate-vulnerable countries globally (Perfecto, 2025), a fact underscored by its national climate action plan, which explicitly affirms its extreme susceptibility to climate-related and geological hazards, mainly due to its location in the Tropical Cyclone belt and the Pacific Ring of Fire (Republic of the Philippines, 2021). This profound vulnerability is highlighted by a Climate Central (2024) report, which ranks the Philippines third among 51 Asian countries and territories

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for experiencing "*unusual heat*" between December 2023 and February 2024. Such consistent high rankings confirm the Philippines' heightened risk of disaster and exposure to multiple high-intensity hazards (World Food Programme, 2024), with the documented increase in the intensity and frequency of hot extremes (Seneviratne et al., 2021, as cited in Red Cross Red Crescent Climate Centre, 2024) further exacerbating these climatic challenges.

Reflecting these broader climatic shifts, the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) has consistently documented heat indices in numerous regions reaching dangerous levels, typically ranging from 42°C to 51°C (Boton, 2025). PAGASA records for Laoag City in the northern Philippines reveal consistently increasing heat index readings, frequently exceeding the "*danger*" threshold and reaching as high as 46°C, positioning it among the regions most impacted by extreme heat conditions (Argosino, 2024). These extreme heat conditions significantly escalate the incidence of heat-related illnesses such as heat exhaustion and heatstroke, presenting grave public health concerns (Garcia, 2024).

The increase in seasonal temperatures, intensified by climate change, has consequences that go beyond environmental degradation. It significantly disrupts the educational process by negatively impacting classroom environments and hindering learners' ability to learn effectively (Jenkins, 2024). Empirical data support this, as a 2023 survey conducted by the Alliance of Concerned Teachers–National Capital Region (ACT-NCR) revealed that approximately 67% of teachers reported difficulties in maintaining learners' concentration during extreme heat conditions. Furthermore, 86.6% of respondents observed a significant decrease in learners' concentration, while nearly 40% reported an increase in absences due to symptoms such as dizziness, headaches, and nosebleeds linked to elevated classroom temperatures. These findings are corroborated by Quinto and Anoche (2024), whose research underscores the pervasive negative impact of extreme heat on education. Teacher respondents strongly agree that it adversely affects classroom management, learner concentration, attendance, participation, overall learner health, and the adequacy of physical infrastructure in mitigating high temperatures.

While previous studies have documented the broader educational consequences of heightened seasonal heat, a notable gap remains in localized research specifically addressing the experiences of teachers. Limited attention has been given to the practical challenges teachers encounter and the mitigation strategies they implement within classroom environments in response to these elevated temperatures.

To address this gap, this study aimed to examine the lived experiences of public elementary teachers within the Schools Division of Laoag, specifically focusing on the challenges posed by heightened seasonal heat and the mitigation strategies they employed. The findings of this research were expected to contribute significantly to the development of evidence-based recommendations for strengthening teacher support, guiding policy interventions, and enhancing educational resilience in the face of escalating climatic challenges.

Review of related literature and studies

This section provides a review of related literature and studies on the topics relevant to this research, with a specific focus on Department of Education policies in response to heightened seasonal heat, the challenges faced by elementary teachers due to such heat, and the mitigation strategies employed by teachers to address these challenges.

Department of education policies on heightened seasonal heat

With the dangerously high temperatures in the Philippines during 2024 and 2025 attributed to the ongoing El Niño phenomenon, the Department of Education (DepEd) has implemented measures to safeguard the health and safety of learners, teachers, and non-teaching personnel. DepEd Order No. 24, s. 2022 (referred from DepEd Order No. 37, s. of 2022, s. 2021), titled *Department's Revised Guidelines on Class and Work Suspension During Disasters and Emergencies*, outlines the protocols for suspending in-person classes amid severe weather conditions.

The memorandum does not mandate automatic suspension of classes due to extreme heat. Local government officials (LCEs) are authorized to implement localized suspensions in response to local conditions and circumstances. The Schools Division Superintendent (SDS) must coordinate with local government units (LGUs) to manage suspensions and provide alternative learning methods, such as modular distance learning, performance tasks, and make-up classes, to ensure learning competencies are met (DepEd, 2024). If severe heat poses a threat to health, school heads and Alternative Learning System coordinators may suspend in-person classes without a declaration from the local government. PAGASA issues heat index advisories at 5:00 pm the day before school, with schools switching to Alternative Delivery Mode (ADM) when the heat index reaches 40°C to protect learners. Local government units have also established specific ordinances, such as automatically suspending classes when temperatures rise to 42 ℃ and above, and the Alternative Delivery Mode (ADM) is implemented (Garcia, 2024).

Challenges faced by elementary teachers due to heightened seasonal heat

Despite classes not being suspended and weather forecasts indicating temperatures below 40°C, both learners and teachers frequently encountered extreme heat, which had a negative influence on the teaching and learning process. As revealed in Hussaini's (2023) study, climate change, including extreme heat, has both direct and indirect impacts on teaching effectiveness and learning outcomes. These effects have made classrooms increasingly unsuitable for effective teaching and learning, as extreme weather conditions intensify the challenges within the educational environment (Haßler et al., 2024).

One of the most pressing issues arising from current conditions is the extreme seasonal heat, which creates significant challenges for both teachers and students. Classrooms are frequently described as "*like an oven*" (Suguitan, 2023), with temperatures consistently recorded as "*really hot"* (Pena, 2024). This extreme heat is causing widespread discomfort and impacting the learning environment. A survey by the Alliance of Concerned Teachers of the Philippines – National Capital Region (ACT-NCR) revealed that more than 75% of teachers found the heat "*unbearable*," prompting some to consider early retirement (Ramos, 2024). Further highlighting the severity of the issue, a recent poll indicated that approximately 90% of both teachers and learners experience heat stress during class (Algo, 2024). These

findings are supported by empirical research, with a study by Lala and Hagishima (2024) finding that 74% of teachers described their classrooms as "*uncomfortably hot*" or "*very hot*" during heatwave conditions. Extreme heat also has a profound impact on educational effectiveness. Elevated temperatures make classroom management difficult and reduce teacher-student engagement (Pinugu, 2024). A study by Lala and Hagishima (2023) found 61% of primary teachers reported high temperatures interfered with their teaching, compromising not only student learning but also teacher productivity. This makes it evident that hot classrooms do not just pose a threat to students' learning, but also affect teachers' work productivity.

Extreme heat also has far-reaching consequences for learners' behavior, well-being, and academic performance. According to Lala and Hagishima's (2023) study, *Impact of Escalating Heatwaves on Students' Well-Being and Overall Health*, 96% of teachers noticed a decrease in learners' focus and concentration during extreme heat, with 54% recognizing the considerable influence on academic performance. Similarly, a report by the Regional Educational Laboratory Program (2018), cited by Federico (2023), found that heat-induced discomfort causes learners to shift their focus away from learning tasks and toward bodily signals, prioritizing homeostasis, which hampers concentration and participation in classroom activities. Alarcon (2023), a teacher at Laput Elementary School in Pampanga, further emphasized that high temperatures lead to restlessness and exhaustion, making it difficult for learners to concentrate and retain knowledge. It drains learners' energy, leaving them fatigued and uninspired to engage in learning, ultimately reducing their academic productivity and overall classroom engagement. The discomfort caused by extreme temperatures diverts the brain's focus from processing and retaining information, as the body prioritizes regulating its temperature. This is supported by Folkerts et al. (2020), who assert that extended exposure to extreme heat can impair cognitive functions, slowing information processing, attention, and memory. This led to emotional and behavioral issues, such as irritability and reduced motivation. These factors create a negative cycle that affects both learning and the overall mental and emotional well-being of students, making it harder for them to stay focused and engaged, which in turn impacts their academic performance.

Moreover, extreme heat presents significant health challenges that further complicate the educational environment. The Alliance of Concerned Teachers (ACT) conducted a study of 11,000 teachers from March 24 to 27, 2023, and found that 37% indicated that extreme heat impacted their health issues, including dizziness and migraines, affecting both teachers and learners. Additionally, 26% of teachers reported hypertension, while children were found to be particularly vulnerable due to their less efficient temperature regulation. The survey also indicated that 87% of learners faced challenges arising from pre-existing conditions, such as allergies and asthma, which heightened their susceptibility to heat-related health issues, including colds and coughs (Save the Children, 2024). As Azan et al. (2025) contended, excessive exposure to elevated ambient temperatures renders children uniquely susceptible to extreme heat-related morbidity and mortality. This is attributed to several interconnected physiological and behavioral factors, such as their comparatively lower body mass, elevated metabolic rates, underdeveloped thermoregulatory mechanisms, and distinct behavioral patterns. Furthermore, extreme heat has been linked to increased absenteeism, with 40% of ACT survey respondents observing an increase in learners' absenteeism. This is similar to Schneider et al.'s (2024) findings, which showed the negative impact of extreme heat on school attendance. Higher temperatures cause more frequent

absenteeism due to heat-induced fatigue and illness. These health-related absences might result in a reduction of learning opportunities, potentially leading to long-term educational setbacks for affected learners.

In addition to these health concerns, the physical infrastructure of schools worsens the effects of extreme heat. Classrooms with inadequate ventilation and infrastructure are particularly vulnerable to rising temperatures. Teachers from Eastern Samar and Cotabato City noted that poor ventilation worsens the effects of rising temperatures, causing discomfort for learners (Save the Children, 2024). A teacher from Nueva Ecija stated that even with four fans for 16 learners, excessive heat persists, especially in classrooms with 30 or more learners (Peña, 2024), while a survey by ACT-NCR found that nearly 46% of teachers had only one or two fans in their classrooms. Malfunctioning fans compound the situation, as Miranda's (2024) study discovered that broken ceiling fans leave the remaining fans inadequate for cooling a class of 40 learners. The inadequacy and malfunction of electric fans directly contribute to poor classroom ventilation. This is particularly concerning, given that Bakó-Biró et al. (2012) showed that inadequate ventilation in educational environments causes the accumulation of carbon dioxide (CO2) emitted by occupants. Due to limited air exchange, CO2 concentrations increase during instructional periods. This directly harms indoor air quality and is linked to thermal discomfort, reduced cognitive concentration, and ultimately, poorer learning outcomes for students, particularly in overcrowded and poorly ventilated classrooms.

Mitigation strategies used by elementary teachers to address heightened seasonal heat

In response to increased seasonal heat, teachers have implemented strategies to improve the learning environment. Kreuch (2024) underlined the necessity of teachers recognizing how extreme weather affects learners' behavior and adjusting their teaching methods to keep them engaged and focused. Teacher Jhong Barrientos Casungcad of Lutucan Integrated National High School addresses heat by holding classes in open fields, allowing learners to enjoy fresh air during exams. Similarly, Mark Anthony Dela Rosa Dalipe of Catanduanes State University suggested holding lessons under trees to improve comfort. Raymund Samudio from Roberto H. Tirol National High School also expressed a preference for outdoor lessons to avoid the heat in classrooms (Suguitan, 2023). These adaptive strategies align with Yoesoep Edhie Rachmad's (2022) Learning Adaptation Theory, which emphasizes the need for adaptation in the learning process, particularly in the face of environmental challenges such as extreme weather. By adjusting teaching methods to external conditions, teachers facilitate a more conducive learning environment that enables learners to maintain focus and engagement, improving learning outcomes despite environmental challenges.

Additionally, hydration and proper ventilation are crucial in addressing the challenges posed by heightened seasonal temperatures in educational settings. Sheila Marie A. Primicias, City Schools Division Head in San Fernando City, La Union, implemented the Hydration Water Break initiative across several schools. This program schedules water breaks at 9:00 a.m., 11:00 a.m., 1:00 p.m., and 3:00 p.m. daily to help learners stay hydrated, refreshed, and focused throughout the day. The initiative highlights the importance of regular water breaks to replenish fluids, enhance brain function, and reduce fatigue (Quitasol, 2024). Similarly, teachers in Eastern Samar and Cotabato City have emphasized the significance of water breaks and adequate ventilation to alleviate the effects of excessive heat (Save the

Children, 2024). Sheader (2025) further underscores the importance of establishing regular water breaks, recommending that teachers schedule them after tasks or lesson transitions, provide easy access to water, and lead by example to encourage learners to prioritize hydration. Hydration breaks are supported by the findings of Bandara and Fernando (2023), who noted that water is essential for the body as it supports metabolism, thermoregulation, cellular balance, circulation, and cognitive functions. Maintaining adequate hydration among learners is vital for sustaining critical bodily functions. Despite its affordability, its role in maintaining health and supporting effective thinking and learning is highly valuable.

Moreover, maintaining proper ventilation within classrooms is crucial for addressing the challenges posed by high temperatures, a point supported by Bidassey-Manilal et al. (2016), who recommend prioritizing adequate classroom ventilation, including the installation of ceiling fans where electricity is available, to help cool spaces when windows and doors are open during hot weather. According to Marquez et al. (2020), improving ventilation in schools fosters a more productive and enriching learning environment where students feel motivated to perform better and engage more actively in class discussions, resulting in improved overall academic results. Ensuring the classroom climate is in optimal condition is critical for creating a truly suitable place for learning.

Conceptual framework

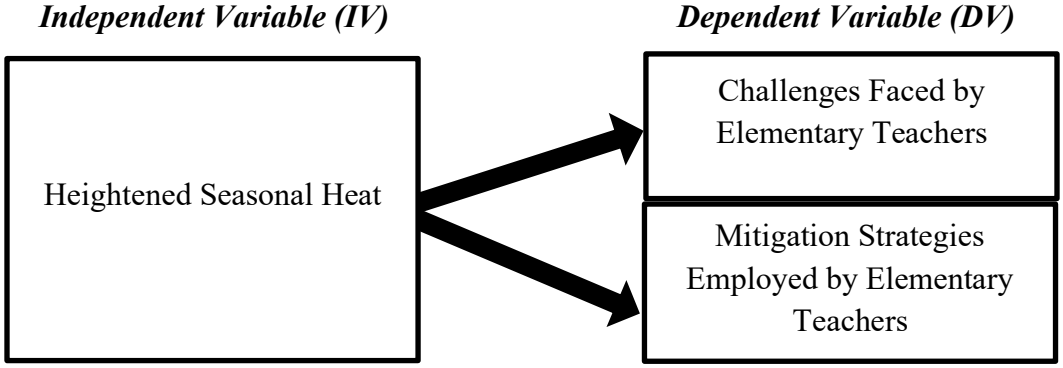

Figure 1. Research Paradigm

Figure 1 illustrates the conceptual framework of the study, based on the Independent Variable-Dependent Variable (IV-DV) model, which examined the impact of heightened seasonal heat on educational outcomes. Specifically, the independent variable (IV) was the heightened seasonal heat, which affected the teaching and learning process. The dependent variables (DV) included the challenges faced by elementary teachers, such as impacts on learners' behavior (e.g., focus, participation, and attendance), teaching effectiveness, and the health of both learners and teachers. The study also explored the strategies employed by teachers to mitigate these challenges, including instructional modifications and varied pedagogical strategies, hydration breaks, and improved ventilation.

Statement of the problem

This study aimed to explore the challenges faced by public elementary teachers and the mitigation strategies employed in managing the heightened seasonal heat. Specifically, this study sought answers to the following questions:

1. What are the primary challenges faced by public elementary school teachers as a result of heightened seasonal heat?

2. What are the mitigation strategies pursued by elementary teachers to minimize the negative effects of seasonal heat on teaching and learning?

Research methodology

Research design

This study employed a descriptive phenomenological approach to explore the lived experiences of public elementary school teachers concerning heightened seasonal heat and its impact on the teaching and learning process. As Tumapon (2024) explains, the phenomenological approach focuses on the lived experiences of individuals and how they perceive and make sense of a particular phenomenon. This approach is well-suited to the study because it allows for an in-depth exploration of the challenges teachers face, as well as the strategies they employ to mitigate the effects of heightened seasonal heat on classroom instruction and student learning.

Research setting

The study was conducted in the City of Laoag, specifically within the Schools Division of Laoag City. Schools in Laoag were chosen because they provide an essential context for the research, as Laoag City is one of the areas in the country where temperatures have reached 45°C, a level classified as "*dangerous*" by the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA).

Research participants

A total of fourteen (14) elementary public teachers within the School Division of Laoag City were purposively selected for this study. The sample size was purposefully kept small to facilitate a thorough phenomenological investigation of both individual and collective experiences. The sample size is consistent with phenomenological research, allowing for an in-depth exploration of teachers lived experiences with heightened seasonal heat while maintaining manageable and rich data (Arize, 2024).

Data gathering instrument

To gather the necessary data for the study, an online questionnaire was employed via Google Forms. It consists of open-ended questions designed to enable teacher respondents to provide detailed and reflective responses, focusing on the challenges they have encountered and the mitigation strategies they have employed to address the consequences of heightened seasonal heat on the teaching and learning

process. Follow-up interviews were conducted via online messaging or video conferencing to clarify responses when necessary.

The questionnaire was developed in alignment with the research problem and validated by educational experts to ensure its relevance and clarity. The questions covered areas such as learner behavior, including focus, participation, and attendance; teaching effectiveness; the health of both learners and teachers; instructional adjustments and pedagogical strategies; hydration breaks; and classroom ventilation.

Data gathering procedure

Prior to conducting the study, open-ended questions for the questionnaire were created and validated by educational experts. Then, teacher respondents were given an online questionnaire with an attached informed consent, which was administered using Google Forms. Although acquiring data online may limit the depth of responses compared to in-person interviews, various tactics were employed to overcome this limitation. Follow-up interviews, conducted via online chat or video conference, were used to clarify ambiguous responses, and respondents were asked to provide detailed explanations.

After acquiring the necessary information, thematic analysis was used to identify key themes and patterns in the responses. The data were thoroughly analyzed and coded to uncover both the challenges that teachers experienced and the strategies they used to mitigate the effects of heightened seasonal heat on the teaching and learning process.

Data analysis tool

The responses from teachers regarding their lived experiences with challenges and the strategies employed to mitigate the impacts of heightened seasonal heat on the teaching and learning process were analyzed using thematic analysis, following the six-phase framework established by Braun and Clarke.

The analysis proceeded through a systematic process, beginning with the familiarization with the data. This was followed by the generation of initial codes, the identification and search for relevant themes, and the subsequent review of these themes. The final stages involved defining and naming the themes, followed by the preparation of the final report. Each phase was carefully executed to ensure a rigorous and comprehensive analysis of the data.

Ethical considerations

Ethical considerations were strictly observed throughout the research process. Ethical approval for the study was obtained, and informed consent was digitally collected from all respondents. Participation in the study was entirely voluntary, with no coercion applied, and respondents were informed of their right to withdraw at any time without facing any penalties or consequences. All collected data were anonymized and securely stored in encrypted systems to ensure confidentiality, following Republic Act 10173, also known as the Data Privacy Act of 2012. Respondents were not exposed to any physical, emotional, or psychological harm during the study, and particular attention was given to their well-being, especially when discussing the sensitive impacts of heightened seasonal heat.

Data presentation and analysis

This part presents findings from structured interviews conducted with public elementary teachers within the Schools Division of Laoag City, organized according to key themes identified during the interviews.

What are the primary challenges faced by elementary school teachers as a result of heightened seasonal heat?

Table 1. *Elementary teachers' challenges on heightened seasonal heat*

Themes	Contributing Sub-Themes	Frequency
Theme 1: Increased Teacher Stress and Burnout	physical discomfort and fatigue	10
	mental and cognitive strain	10
	reduced classroom management capacity and instructional effectiveness	12
Theme 2: Diminished Focus and Concentration	discomfort and restlessness	6
	easily distracted and irritability	8
	mental absence and shortened attention span	7
	difficulty processing information	2
Theme 3: Decreased Participation and Engagement	physical discomfort and fatigue	9
	shortened attention spans	5
	avoidance of movement	4
	lack of energy and being distractibility	7
Theme 4: Heat-Related Illnesses and Rising Absenteeism	physical discomfort and heat-induced illnesses such as dizziness, dehydration, fever, cough, colds, headaches	10
	going home early and numerous absences	9
	disruption to the learning process	9
	missed lessons and assessments	6
Theme 5: Inadequate Classroom Ventilation	hot and uncomfortable classroom	11
	malfunctioning electric fans	7
	lack of electric fans	3
	electricity shortage	1

Source: *Researcher's Analysis of Respondent Data*

Theme 1: Increased teacher stress and burnout

Higher temperatures substantially increase teacher stress and burnout, causing teachers to experience both physical and mental exhaustion, which in turn impacts their overall well-being and effectiveness. Teacher respondents consistently indicated that the discomfort from heightened seasonal heat renders their teaching more tiring, difficult, and challenging, decreasing instruction delivery efficiency. Numerous respondents expressed their dissatisfaction regarding how extreme heat impacted their teaching experience, with Respondent 10 pointing out, *"High temperatures made teaching more tiring and challenging, especially since the uncomfortable heat and sweating create barriers to effective*

teaching." This discomfort diminishes teachers' concentration and vitality while also interfering with classroom engagement and learner behavior, exacerbating burnout and negatively impacting teacher performance. In line with these findings, Lala & Hagishima (2023) found that hot classrooms pose a threat to students' learning and studying, and also affect teachers' work productivity, with 61% of teachers identifying temperature as their primary source of discomfort.

Theme 2: Diminished learner's focus and concentration

Increased seasonal temperatures impair learners' capacity to maintain focus, concentration, and motivation during classroom instruction. Teacher responses indicated that increased temperatures result in physical discomfort, which is reflected in symptoms such as restlessness, irritability, and fatigue among learners. Physiological and behavioral responses to heat adversely affect cognitive engagement, hindering learners' ability to maintain focus, process information, and participate actively in lessons. Respondent 8 noted, *"Extreme heat made learners more restless, distracted, and easily fatigued. Their focus, concentration, and motivation to participate in activities were negatively affected."* Frequent discomfort often overshadows the lecture, causing learners to become mentally disengaged while physically present, which in turn leads to poorer classroom participation and overall academic performance. Heat-induced physical strain diminishes cognitive engagement and enthusiasm, compromising learners' learning experiences. Consistent to a point emphasized in the study by Quinto and Anoche (2024), where teacher respondents concurred that climate change-induced weather patterns, particularly increasing temperatures, adversely affect class dynamics by diminishing learners' focus, participation, and overall energy during lessons.

Theme 3: Reduced participation and engagement

Elementary teachers observed heightened seasonal heat as a factor contributing to reduced participation and engagement in classroom activities. It induces discomfort and fatigue, reducing learners' energy levels and hindering their ability to maintain attention or engage actively. Teachers explained that during hot weather, particularly in the afternoon, learners often exhibit lethargy, distraction, and diminished motivation, opting to remain seated or silent instead of participating in discussions or activities. Respondent 12 pointed out, *"The heat has made learners less active and less interested in joining classroom activities."* Temperature is a crucial meteorological variable that influences mood, with high temperatures often associated with negative emotional states, including aggression, hysteria, and apathy (Cao and Wei, 2005, as cited in Sugianto and Huang, 2020). This impact on emotional well-being extends to the learning environment. Research indicates that heat exposure demonstrably decreases intrinsic motivation (Wargocki et al., 2019), subsequently reducing academic engagement. This academic disengagement is acutely experienced in classroom settings, where physical discomfort and heat stress become significant impediments to learners' participation, a finding consistent with previous research (Lala & Hagishima, 2023; Miranda et al., 2024; Carlson & Shepardson, 2024).

Theme 4: Heat-related illnesses and rising absenteeism

The responses from teachers reveal a strong correlation between increased seasonal temperatures and the incidence of heat-related illnesses among learners. Symptoms including dehydration, dizziness, headaches, fatigue, fever, colds, and cough are common, with numerous learners experiencing increased severity during extreme heat conditions. This results in higher absenteeism, as learners either miss school

or depart early due to fatigue caused by heat. Respondent 3 stated, *"Hot temperatures have resulted in increased absences, with learners experiencing heat-related illnesses such as dehydration, dizziness, fatigue, fever, headaches, cough, and colds."* Parsons (2014) supports the health risks associated with extreme heat, stating that prolonged exposure to high temperatures can impair the body's ability to regulate internal temperature, resulting in heat-related illnesses that disproportionately affect vulnerable populations, such as children. Health concerns have a significant impact on students' school attendance, resulting in increased absenteeism, which disrupts learning continuity and lowers academic achievement. According to a 2023 Harvard study, rising temperatures are associated with increased absenteeism and behavioral concerns in schools with inadequate ventilation, highlighting the negative consequences of excessive heat on children's health, attendance, and academic engagement (Lufkin, 2024).

Theme 5: Inadequate classroom ventilation

Responses from teachers reveal a recurring theme of environmental discomfort resulting from inadequate ventilation and malfunctioning electric fans during high seasonal temperatures. The electric fans available are frequently inadequate or non-operational, thus failing to mitigate the extreme heat. Inadequate ventilation exacerbates the conditions, leading to an excessively warm and uncomfortable classroom environment. These conditions hinder learners' focus, engagement, and behavior while also presenting challenges for teachers in maintaining effective instruction and classroom management. Respondent 6's statement highlights the issue: *"Malfunctioning electric fans and poor ventilation have made the classroom unbearably hot at times, making it difficult to maintain a calm and focused atmosphere."* This concern is further supported by a survey conducted by ACT, which found that 4 out of 10 teachers reported that no action was taken to address the issue, with many stating that the existing fans were inadequate to alleviate the heat (Erram, 2024). Supporting this, Wargocki and Wyon (2017) found that inadequate ventilation in classrooms and high indoor temperatures lead to heat buildup and poor air quality, disrupting classroom management and learning among teachers and learners.

What mitigation strategies do elementary school teachers implement to address both the immediate and long-term effects of heightened seasonal heat on the teaching and learning process?

Table 2. *Elementary teachers' mitigation strategies on heightened seasonal heat*

Themes	Contributing Sub-Themes	Frequency
Theme 1: Instructional Modifications and Varied Pedagogical Strategies	shorter interactive activities	10
	use of technology and multimedia	4
	group work and collaborative learning	6
	pacing and flexibility in lessons	4
	reward systems	3
	differentiated and flexible activities	2
Theme 2: Utilization of Outdoor and Nature-Based Learning Activities	shaded outdoor spaces	4
	short and refreshing outdoor activities	4
	outdoor hands-on learning	3
	nature engagement and comfort	3
	regular hydration reminders and access to water	12

Theme 3: Hydration Support and Classroom Comfort Measures	scheduled hydration and cooling breaks	6
	encouraging comfortable clothing	4
	monitoring signs of heat-related discomfort	3
Theme 4: Classroom Ventilation and Airflow Management	maximizing natural ventilation, such as opening windows and doors	8
	purchasing and strategic use of fans	6
	adjusting the seating arrangement	4
Theme 5: Strengthening Classroom Comfort Through Improved Classroom Ventilation	improving classroom infrastructure	6
	investing adequate ventilation and climate control systems	9
	education on heat safety	2

Source: *Researcher's analysis of respondent data*

Theme 1: Instructional modifications and varied pedagogical strategies

A prominent theme emerging from the teacher responses is the modification of instructional methods and the implementation of diverse teaching strategies to mitigate the challenges associated with increased seasonal heat. Teachers shortened lesson durations, incorporated interactive tasks, and utilized collaborative or differentiated activities to maintain learners' engagement despite discomfort. The use of educational technology, games, and reward systems was also reiterated by the teacher respondents as effective for enhancing motivation and participation. As articulated by Respondent 5, *"During periods of high heat, I have found that incorporating short, interactive activities, integrating technology and games, collaborative work, and implementing a reward system helps boost engagement and maintain learners' focus and participation."* The strategic modifications reflect a responsive, learner-centered approach that prioritizes learners' well-being while maintaining instructional effectiveness. This finding is consistent with Quinto and Anoche's (2024) emphasis on the significant impact of climate change on instructional strategies, particularly in sustaining student concentration, and their advocacy for flexible learning options. This perspective is further reinforced by Hattie, as cited in Rostami et. al. (2023), who contends that effective teachers are those who demonstrate adaptability, flexibility, and innovation in their pedagogical practices, modifying their instruction to meet the changing classroom environment. Granziera et al. (2019) also noted that adaptable teachers are more successful in responding to students' needs, particularly when faced with environmental challenges such as extreme heat, thereby ensuring continued instructional effectiveness.

Theme 2: Utilization of outdoor and nature-based learning activities

Teacher respondents frequently utilize outdoor and nature-based learning activities as a strategy to mitigate the challenges posed by seasonal heat. Respondent 6 articulated, *"I have incorporated outdoor learning sessions when possible, taking learners outside for nature walks or hands-on experiments, which not only helps them cool off but also re-engages them with fresh air and a change of scenery."* Teachers intentionally chose shaded and open-air spaces with better ventilation to enhance physical comfort while maintaining educational engagement. Outdoor activities such as nature walks, hands-on experiments, and light recreational tasks not only provided physical relief but also offered opportunities for experiential learning that re-engaged learners. This strategy stresses teachers' proactive efforts to

adapt the learning environment, ensuring instructional quality in the face of climatic challenges. It validates Alarcon's (2023) claim that incorporating outdoor activities in shaded areas provides a refreshing environment and lessens the effects of extreme heat. Almestadi and Alrabie (2019) point out the positive impact of outdoor learning on mental health, particularly in reducing stress and enhancing emotional well-being. As such, these nature-based approaches are not only effective in addressing the immediate physical discomfort caused by extreme conditions but also promote a conducive environment for increased student engagement, motivation, and improved learning outcomes.

Theme 3: Hydration support and classroom comfort measures

The data indicate that elementary teachers can effectively address the problems caused by seasonal heat by implementing a combination of hydration and cooling breaks, as well as classroom modifications. Teachers constantly stressed the value of keeping learners hydrated throughout the day by keeping their water bottles on desks, reminding them to drink water regularly, and setting up water dispensers in the classroom. The importance of including cooling breaks in between tasks to facilitate rest and rehydration was also emphasized by teachers. Some teachers also modified classroom activities to reduce physical exertion and allow learners to wear lighter, more breathable clothing. As stated by Respondent 14, *"I schedule water and cooling breaks, ensure water dispensers are readily available, and encourage learners to wear comfortable clothes and drink plenty of water."* This finding is consistent with previous research indicating that such initiatives are necessary for improving hydration, which in turn improves cognitive function, fosters a positive learning environment, and promotes learners' overall health—all of which contribute to academic success (Mulligan, 2024).

Theme 4: Classroom ventilation and airflow management

Teacher respondents employed diverse strategies to enhance classroom ventilation and mitigate the impacts of seasonal heat. Standard measures included opening windows and doors to improve air circulation, rearranging seating to facilitate airflow, and strategically placing electric fans to enhance ventilation. Some teachers purchased fans at their own expense to improve classroom comfort in areas with inadequate ventilation. Respondent 10 stated, *"In instances of inadequate ventilation in my classroom, I implement strategies such as opening windows and doors, rearranging seating, and personally purchasing electric fans to enhance airflow and improve the environment."* These teacher-led strategies reflect the Department of Health's recommendations for maintaining adequate ventilation and hydration in classrooms to reduce heat stress (Ombay, 2023). They are also strongly supported by the principles of adaptable thermal comfort and the importance of natural ventilation, particularly in tropical regions such as the Philippines. Maximizing airflow through open windows, doors, and fans efficiently reduces pollutants and heat stress (Kwok, 2014). Such thermally comfortable settings improve learning conditions and increase student engagement. Furthermore, adequate ventilation regulates temperature and humidity, which improves cognitive function and promotes a healthier, more productive educational environment (López et al., 2024)

Theme 5: Strengthening classroom comfort through improved classroom ventilation

Elementary teachers recognized the vitality of enhancing classroom settings to mitigate the impacts of seasonal heat. It was suggested to invest in adequate ventilation systems, including electric fans or energy-efficient cooling units, to ensure a comfortable learning environment during extreme

temperatures. Moreover, recognizing the importance of informing both learners and staff about the dangers associated with heat and modifying class schedules emerged as a crucial step for successful heat management. Respondent 1 stated that *"Schools and education authorities can enhance their response to increased seasonal heat by investing in adequate ventilation systems, operational electric fans, or implementing energy-efficient cooling units in classrooms."* This viewpoint is supported by House Deputy Minority Leader Rep. France Castro, who stresses the urgent need for ventilation system improvements and the construction of additional classrooms, particularly given the excessive heat index (Cruz, 2024). López et al. (2024) support this by stating that improving air quality and indoor environmental comfort in educational institutions is regarded as a major factor of both learners' and teachers' physical and cognitive well-being. Improving indoor air quality and comfort levels through adequate ventilation systems is a significant educational imperative and an essential a crucial investment in children's academic progress and teachers' professional efficacy effectiveness.

Results and discussion

The findings of the study provide substantial insight into the challenges experienced by public elementary school teachers in the Schools Division of Laoag City, especially in relation to heightened seasonal heat. Through the lived experiences of the teachers, the study emphasizes the substantial emotional and physical impact that heightened seasonal heat temperatures have on teacher performance, learners' behavior, and classroom dynamics.

Central to the teachers' experiences was the overwhelming sense of stress and burnout caused by the extreme heat. The teachers described feeling physically and mentally exhausted, a concept that resonated with the idea of "teacher burnout." This finding aligns with recent research on teacher burnout, particularly Li et al.'s (2024) study, which demonstrates that environmental stressors, such as increased seasonal heat, contribute to varying degrees of stress that, in turn, influence occupational burnout. The capacity of teachers to regulate their emotions and provide practical instruction can be compromised by heat-related discomfort, as lower satisfaction with thermal conditions, according to Thach et al. (2022), cited in Fretes et al. (2023), is associated with heightened work-related stress.

The impact of heightened seasonal heat is not confined to teachers alone, as it also extends to learners, further emphasizing the connection between the classroom environment and learners' performance. Extreme heat leads to physiological discomfort, including restlessness and fatigue, which severely diminishes learners' focus, concentration, and participation. The findings can be analyzed through the framework of environmental psychology in education (Graetz, 2019), asserting that increased classroom temperature affects the cognitive, emotional, and behavioral dimensions of learning. Extreme heat disrupts learners' focus, impairs their information-processing abilities, and diminishes engagement in learning tasks, thereby obstructing the learning process and fostering negative emotional associations with the educational experience (Goodman et al., 2018).

In addition to the cognitive and emotional effects, heat stress can easily overwhelm the body's thermoregulatory capabilities, leading to a variety of heat-related illnesses. Children are particularly vulnerable to heat stress than adults, mainly because their thermoregulatory systems are still developing

(Early Childhood Scientific Council on Equity and the Environment, 2023). This lack of maturity leads to different responses to extreme heat and restricts their ability to regulate body temperature effectively. This vulnerability, in turn, contributes to absenteeism, which exacerbates learning disparities and deepens the educational divide, particularly in regions where heat intensifies health challenges (Keivabu, 2024). The link between environmental stressors and absenteeism underscores the critical need for comprehensive health and wellness strategies in educational institutions. Kearney et al. (2024) further emphasize that such strategies must incorporate effective climate control measures and a holistic approach to supporting learners' physical well-being to ensure uninterrupted learning and mitigate the long-term impact on educational equity.

In light of the difficulties posed by heightened seasonal heat, teachers have implemented various mitigation strategies to address these issues, such as modifying instructional methods, facilitating outdoor learning, providing hydration support, and improving classroom ventilation. These strategies demonstrate teachers' creativity and resilience in adapting to challenges (Ortiz, 2024) while underscoring hydration as a critical factor that enhances learners' focus, energy, and cognitive performance, thereby promoting greater classroom engagement (Mulligan, 2024). However, these approaches often emerge from necessity rather than institutional support, indicating systemic deficiencies in tackling environmental challenges within the educational setting.

While teachers demonstrate resilience and adaptability in responding to the challenges of heightened seasonal heat, the findings underscore the need for comprehensive, long-term solutions that address both the physical and emotional aspects of teaching in such environments. The primary concern in establishing effective educational settings is ensuring a suitable and conducive learning environment for both teachers and students, with student comfort at its core (Obralić, 2020). Thus, educational authorities must consider environmental factors in the broader conversation on inclusive education. Policymakers and educational leaders should recognize the substantial impact these factors have on teaching and learning, making it a priority to invest in classroom infrastructure that mitigates the effects of extreme heat. Schools should be equipped with adequate ventilation and climate control systems to foster a climate-resilient learning environment for both teachers and learners. Additionally, professional development programs for teachers should not only focus on pedagogical techniques but also incorporate training on managing environmental stressors, promoting teacher well-being, and implementing strategies to maintain student engagement in challenging conditions. By addressing these issues, educational systems can better support teachers and learners in navigating the challenges posed by rising temperatures and create more equitable learning environments.

Conclusion

This phenomenological study examined the challenges faced by public elementary teachers in the Schools Division of Laoag and the mitigation strategies employed to manage the heightened seasonal heat. Analysis of the findings revealed five themes related to the challenges encountered by elementary teachers: increased teacher stress and burnout, diminished learners' focus and concentration, decreased participation and engagement, heat-related illnesses and rising absenteeism, and inadequate classroom ventilation, including malfunctioning electric fans. In response to the impact of heightened seasonal

heat on the educational process, teachers adopted various mitigation strategies. These included instructional modifications and varied pedagogical strategies, outdoor and nature-based learning activities, hydration support and comfort measures in the classroom, classroom ventilation and airflow management, and strengthening classroom comfort through improved ventilation.

The study's findings suggest that educational authorities and policymakers ought to allocate resources toward classroom infrastructure, including adequate ventilation and climate control systems, to establish a climate-resilient learning environment for both teachers and learners. Additionally, specialized professional development or training focused on managing environmental stressors, strengthening well-being, and implementing varied teaching strategies should be provided to teachers to facilitate effective teaching and learning in challenging settings.

Future research may investigate the long-term effects of increased seasonal heat on the teaching and learning process, particularly in relation to teacher effectiveness and learners' academic performance. In addition, researchers may also investigate the effectiveness of various mitigation strategies to mitigate the effects of heightened seasonal heat, including classroom adjustments, outdoor learning, and technological tools, across different educational settings and regions.

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